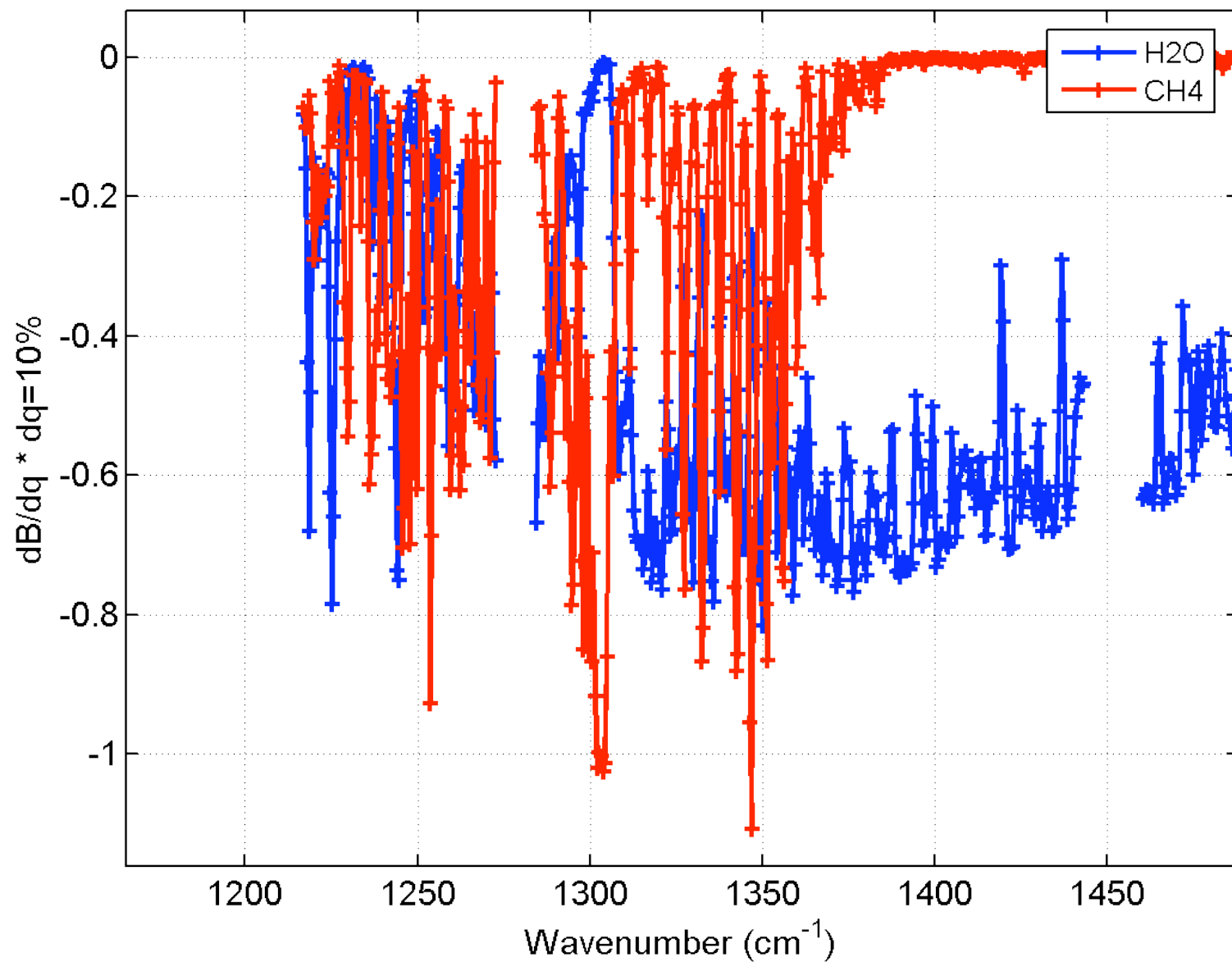


CH₄ Monthly Climatologies with AIRS

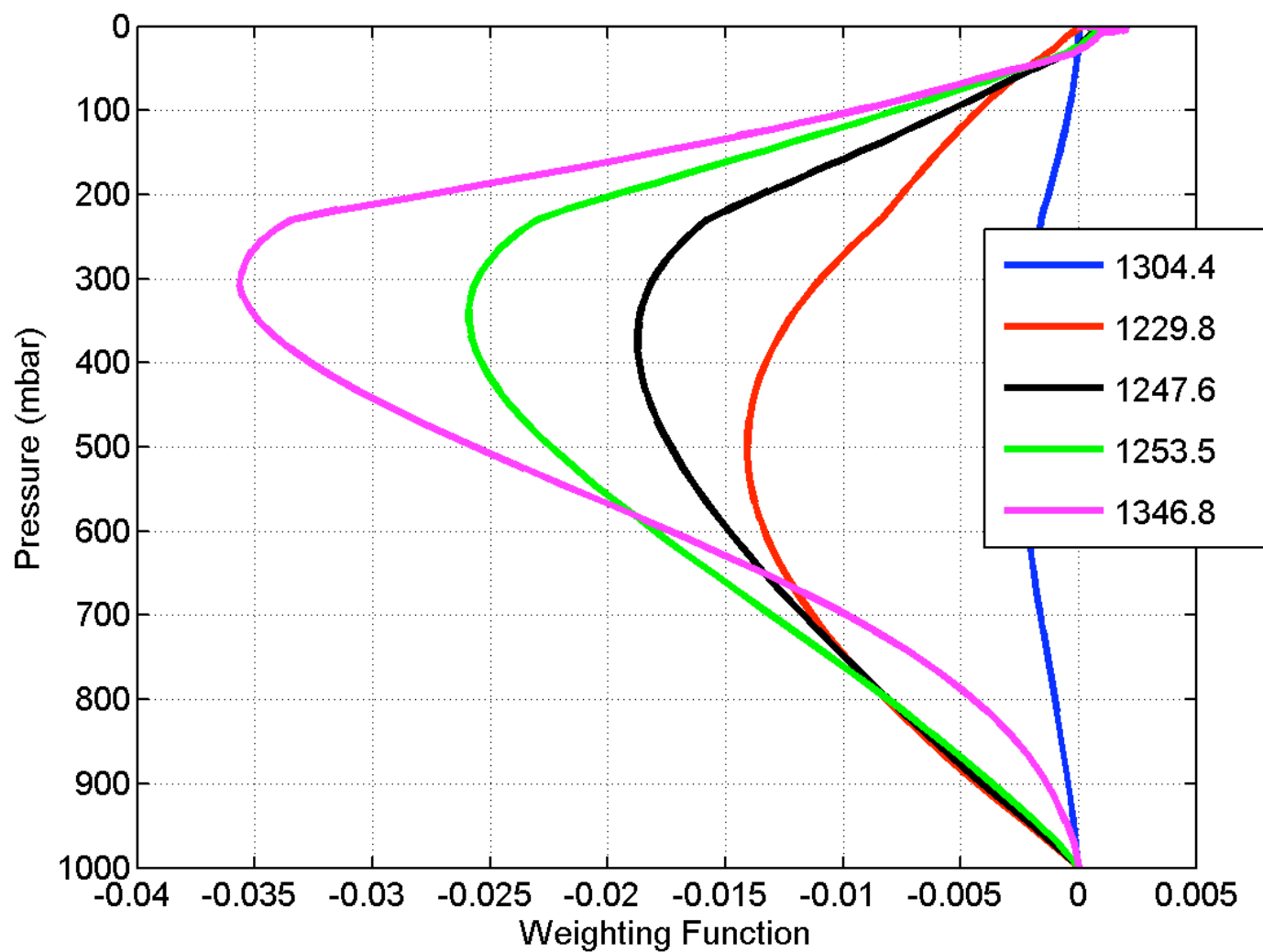
L. Strow and S. Hannon, UMBC Physics Department and JCET

- CH₄ highly variable in the atmosphere, strong greenhouse gas
- Until recently CH₄ was increasing, seems to have stabilized in last few years
- AIRS has many channels sensitive to CH₄
- AIRS bias evaluation using ECMWF reproduces CMDL CO₂ climatology
 - CO₂ signal much smaller, so CH₄ should be easy to measure
 - CH₄ mixed in with water lines
- Present work: evaluate CH₄ variability using ECMWF bias calculations
 - H₂O control channels suggest ECMWF water errors not introducing large errors
 - Examine several channels, validate with MIPAS/ENVISAT, CMDL
 - Upper trop/strat CH₄ variability a problem?
 - Look at yearly trends: will AIRS be competitive with CMDL?

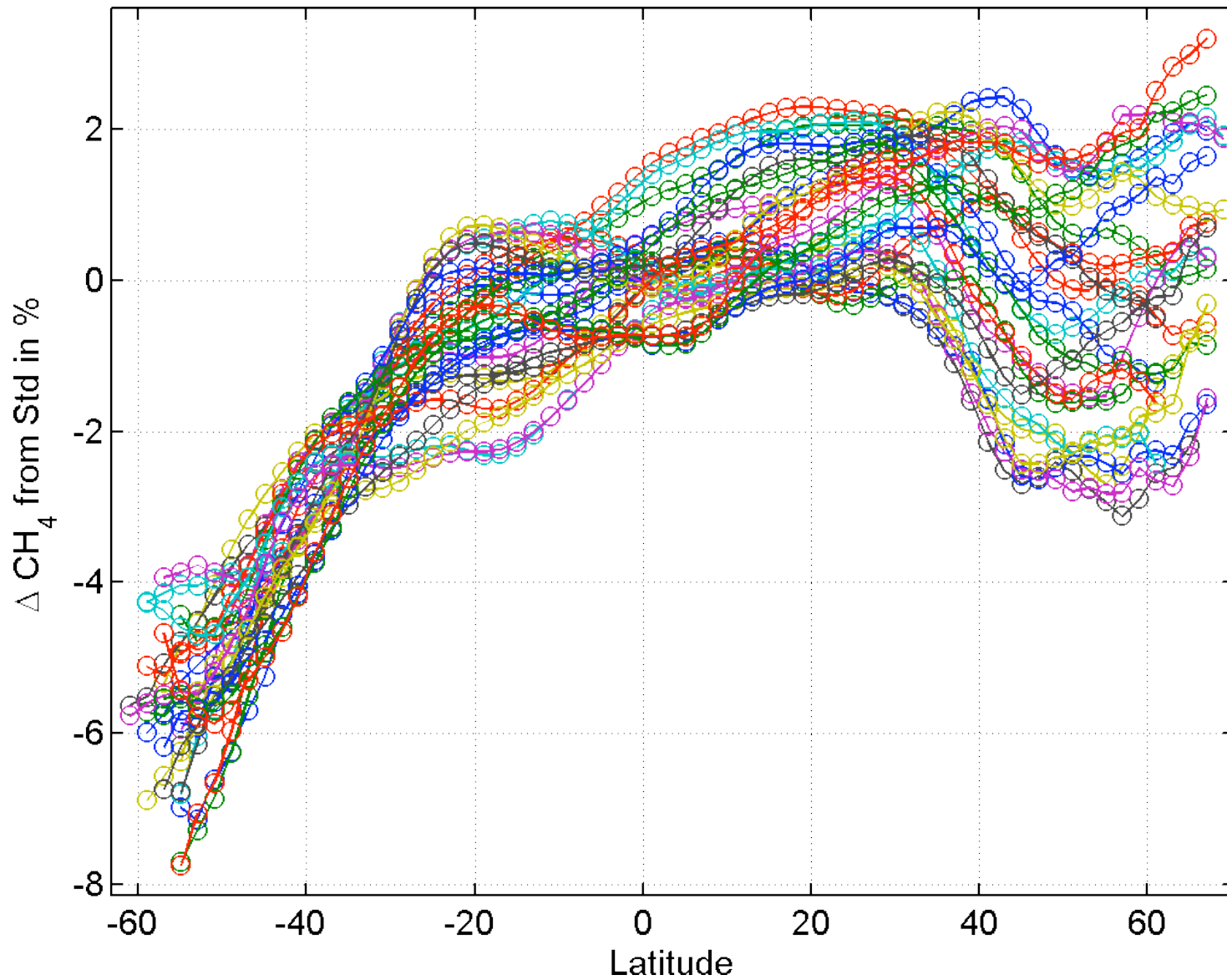
CH₄ Sensitivity



CH₄ Weighting Functions

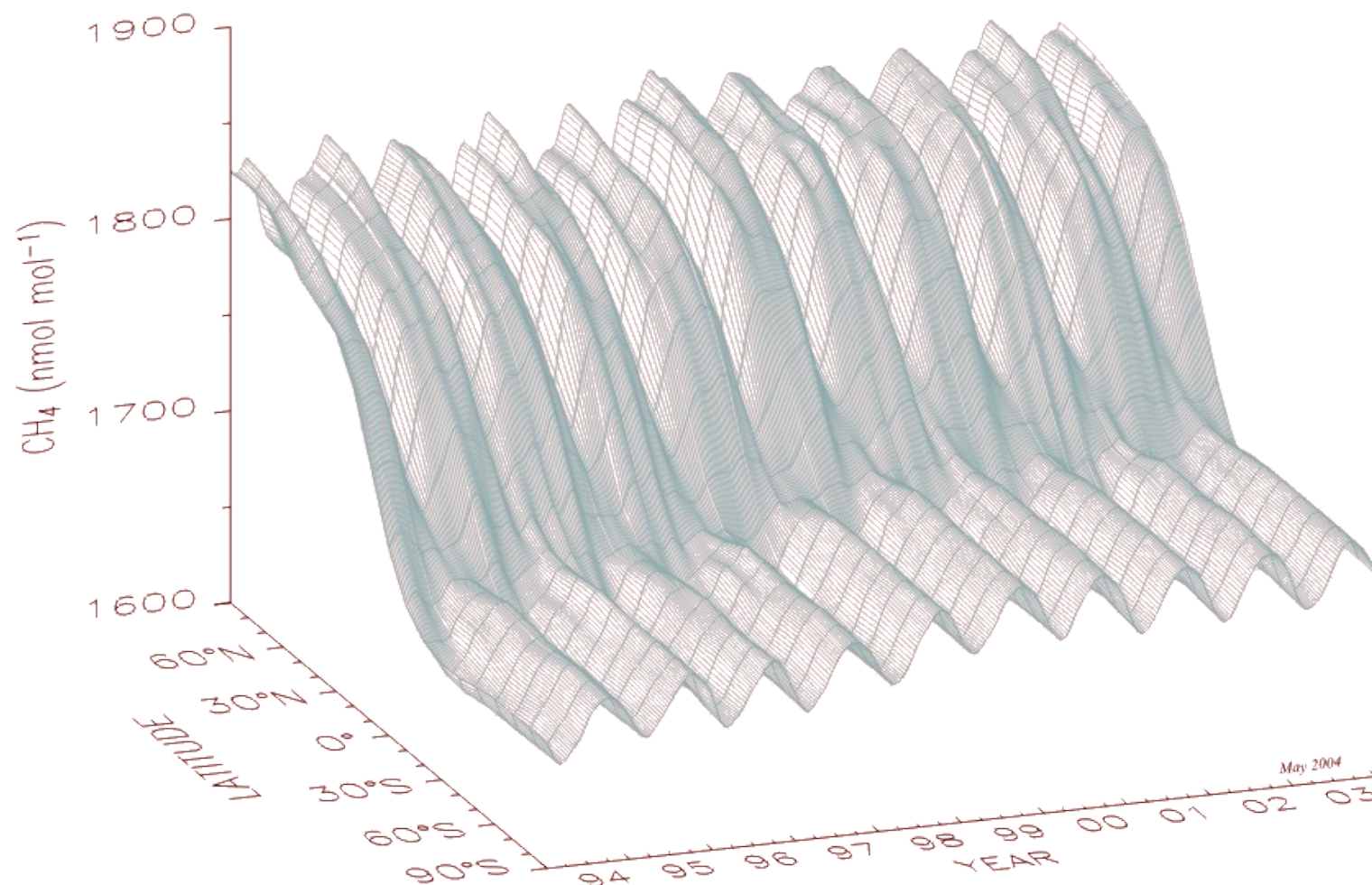


Monthly Biases in % CH₄



Global Distribution of Atmospheric Methane

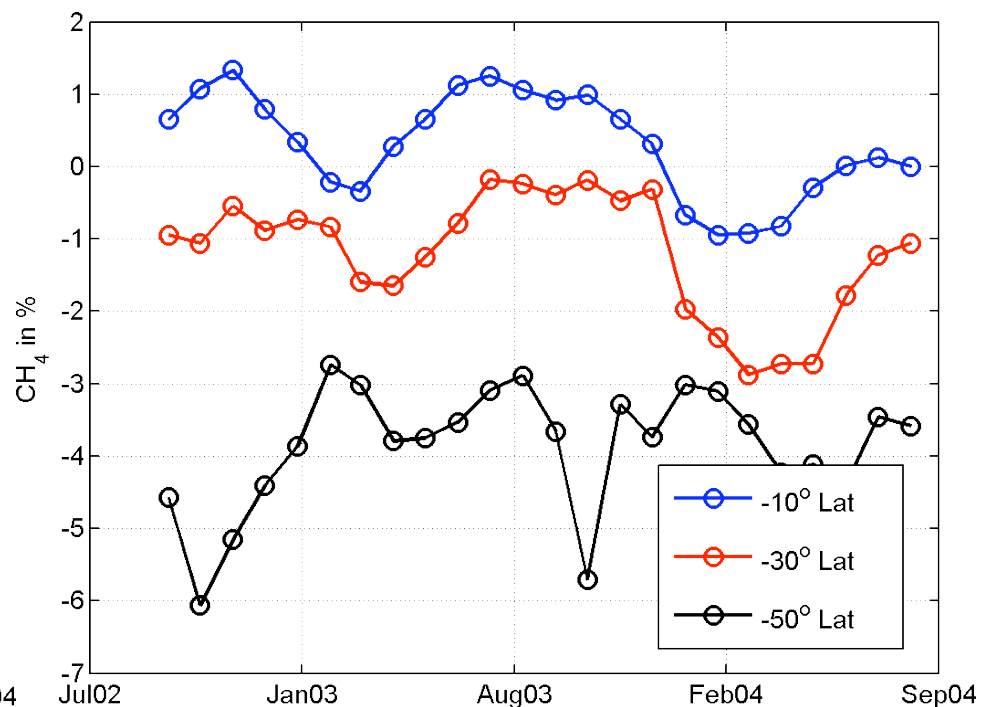
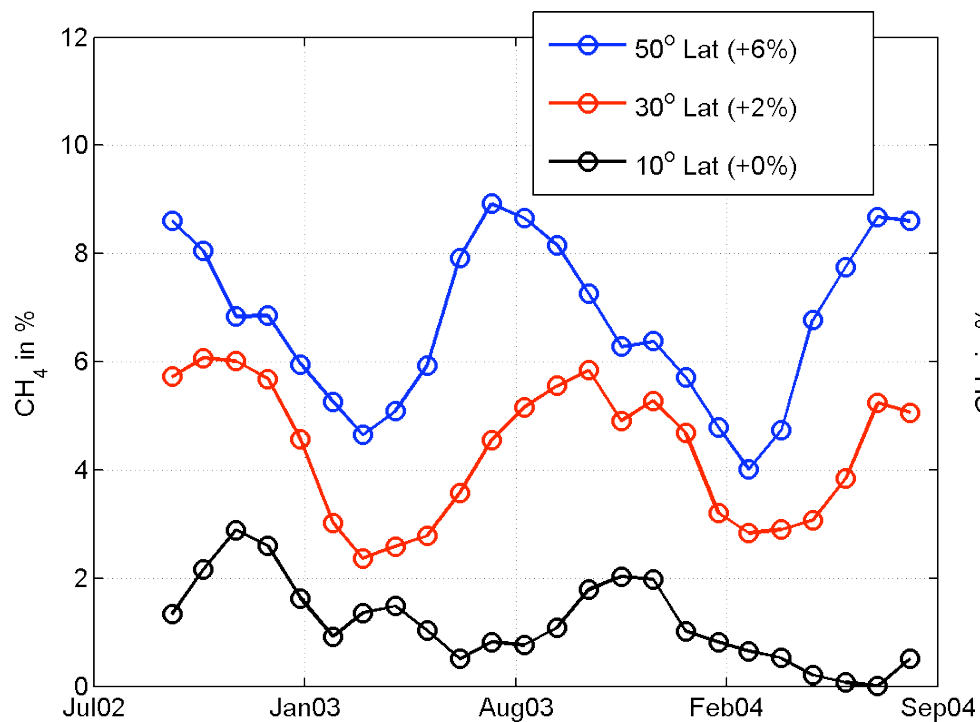
NOAA CMDL Carbon Cycle Greenhouse Gases



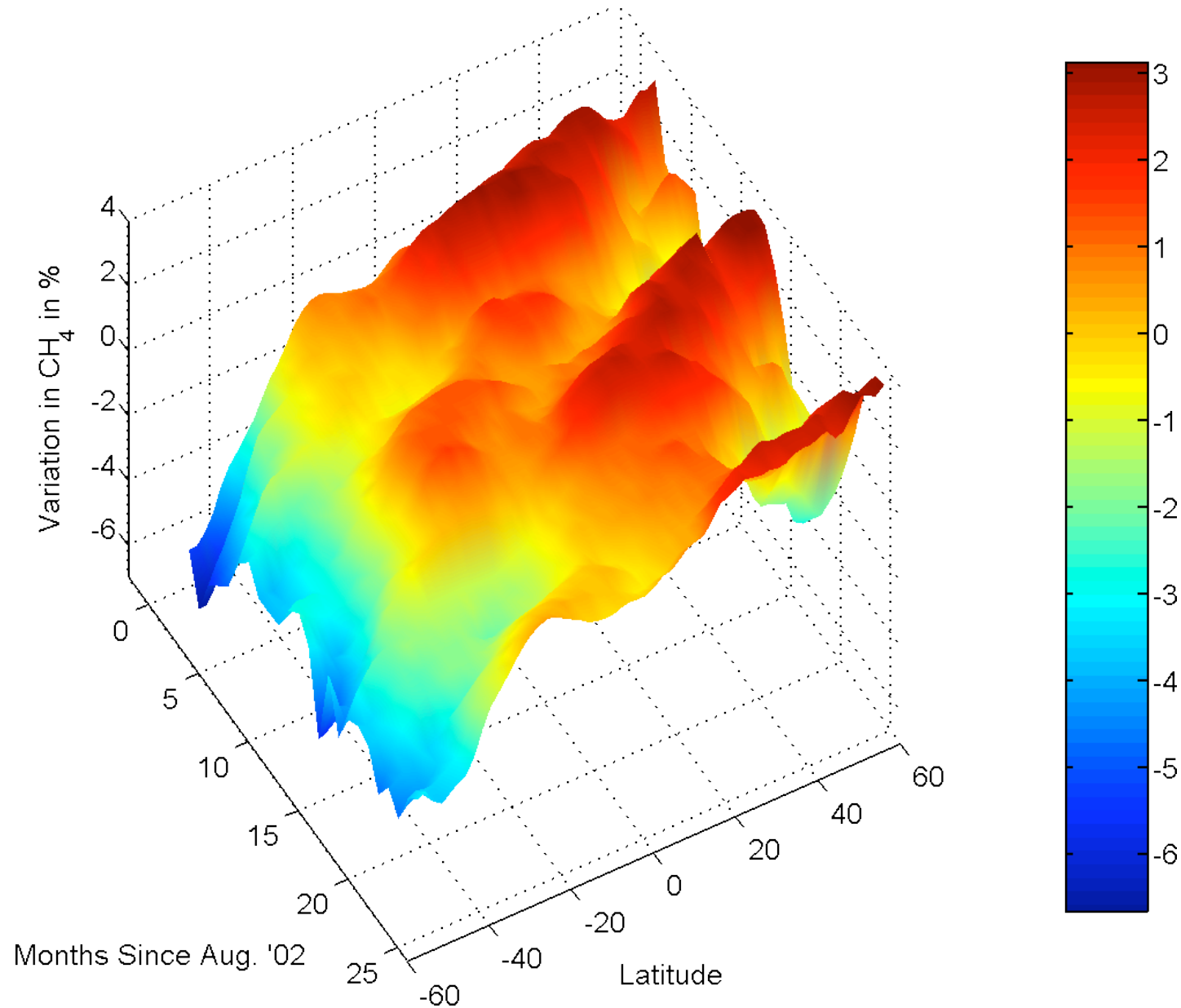
Three dimensional representation of the latitudinal distribution of atmospheric methane in the marine boundary layer. Data from the NOAA CMDL cooperative air sampling network were used. The surface represents data smoothed in time and latitude. Principal investigator: Dr. Ed Dlugokencky, NOAA CMDL Carbon Cycle Greenhouse Gases, Boulder, Colorado, (303) 497-6228 (ed.dlugokencky@noaa.gov, <http://www.cmdl.noaa.gov/ccgg>).



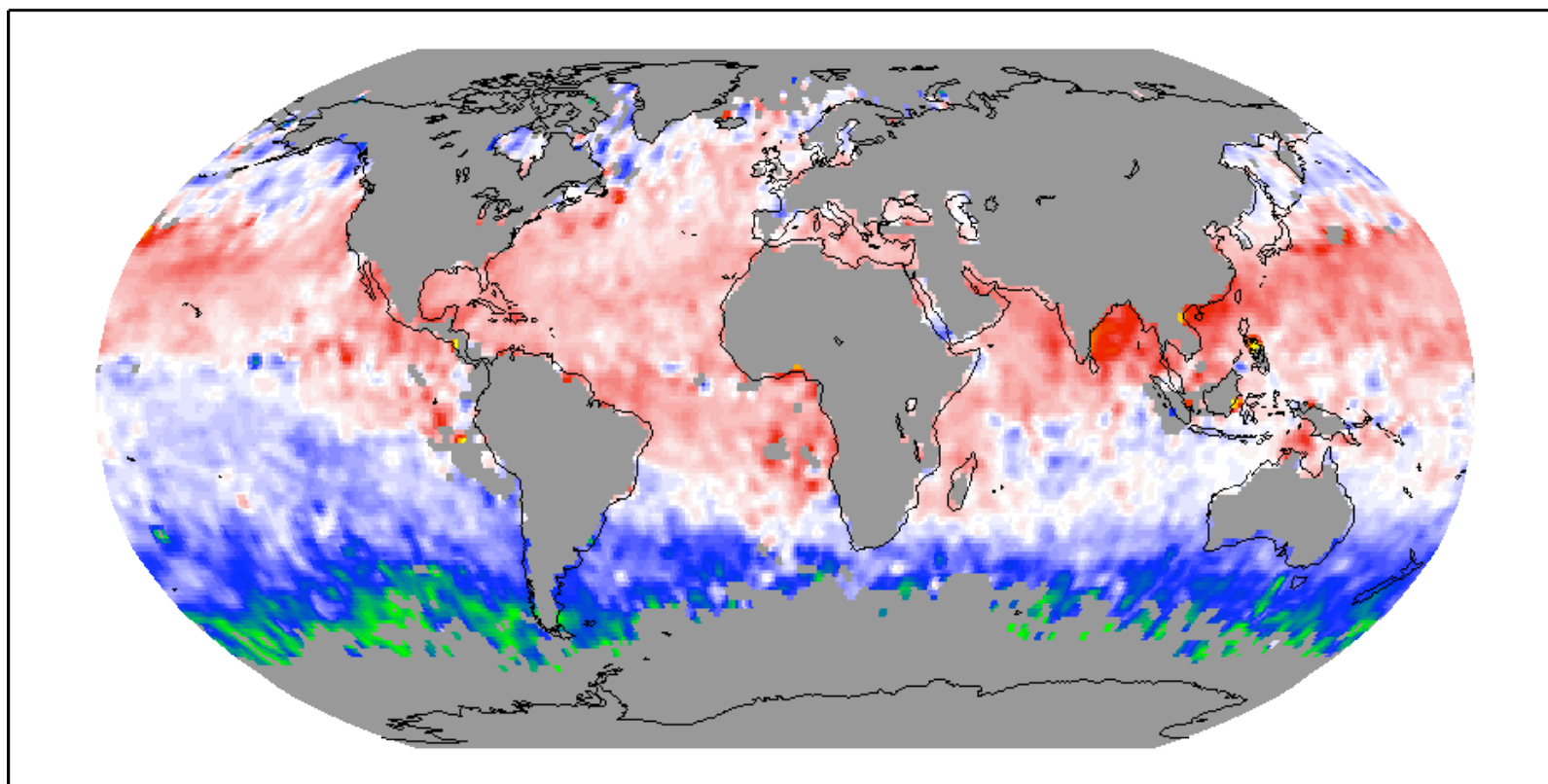
Monthly CH₄ Binned by Latitude (1304 cm⁻¹ Channel)



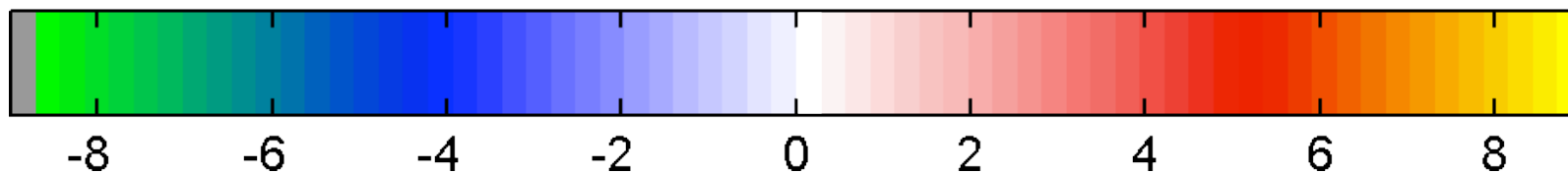
24-Month Zonal CH_4 Climatology



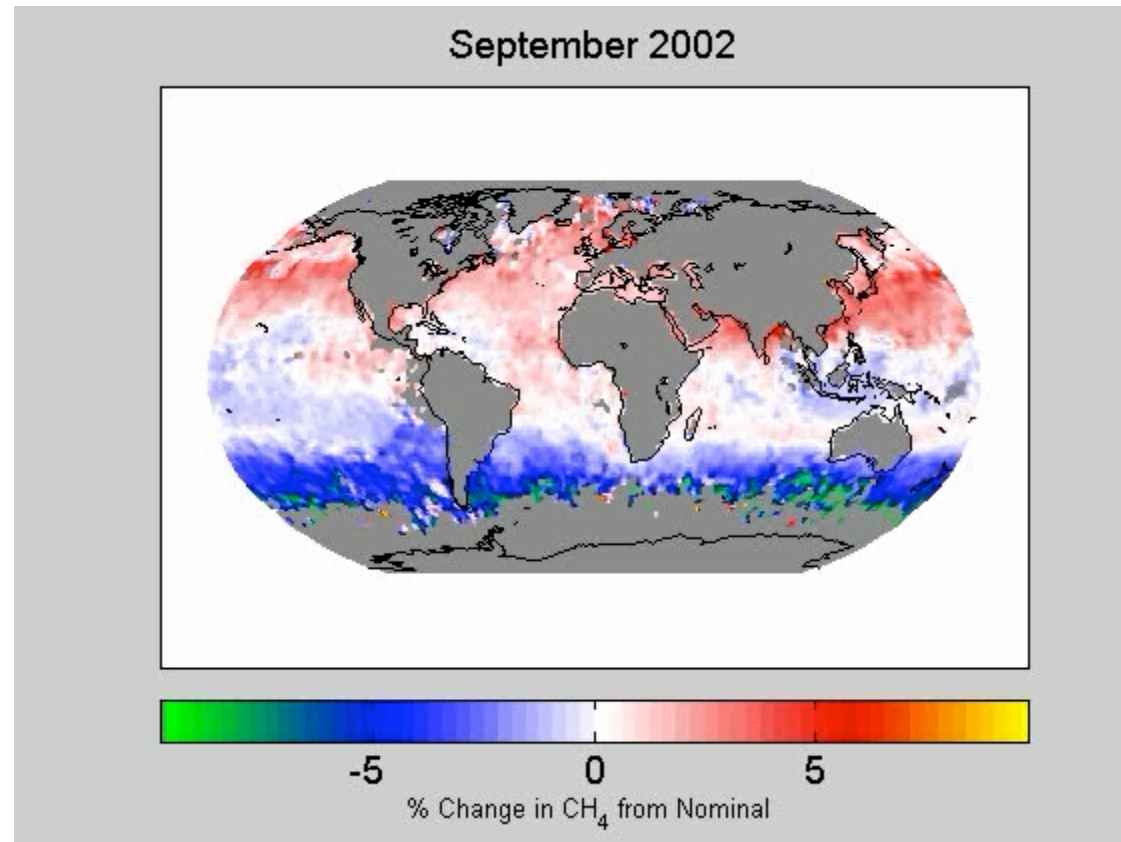
CH₄ October 2003



Deviation from RTA CH₄ Profile in %

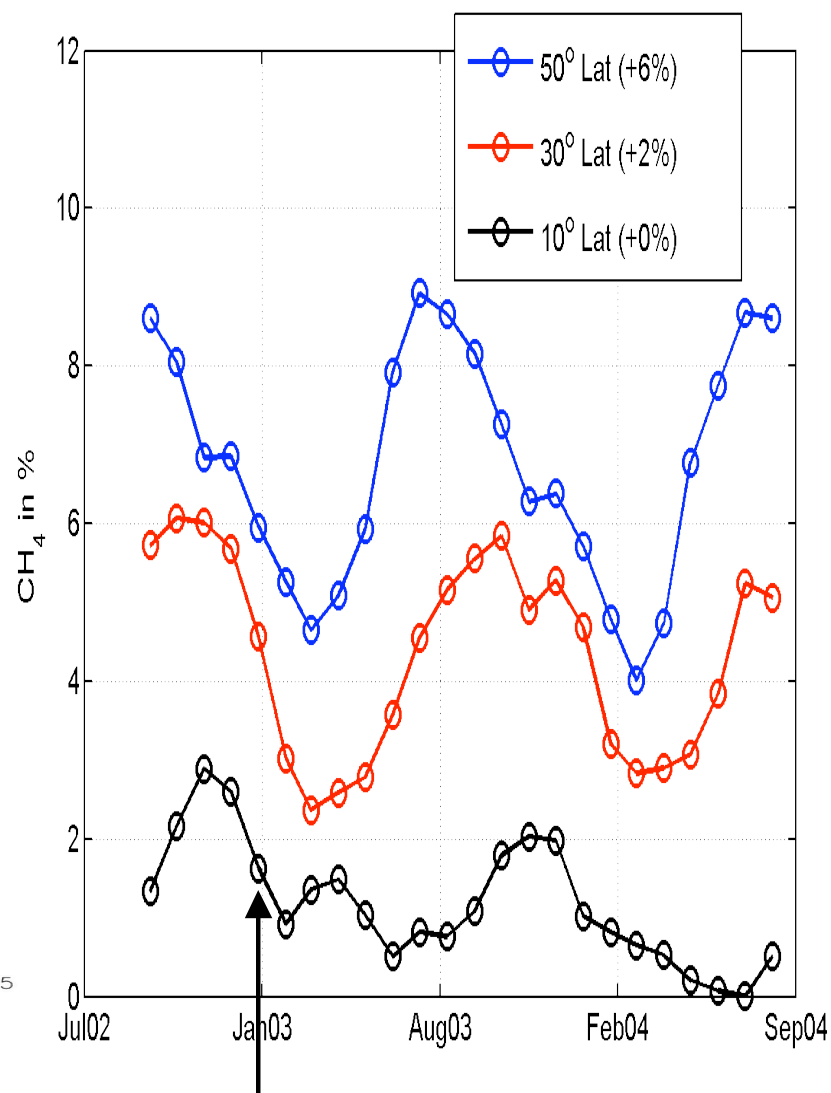
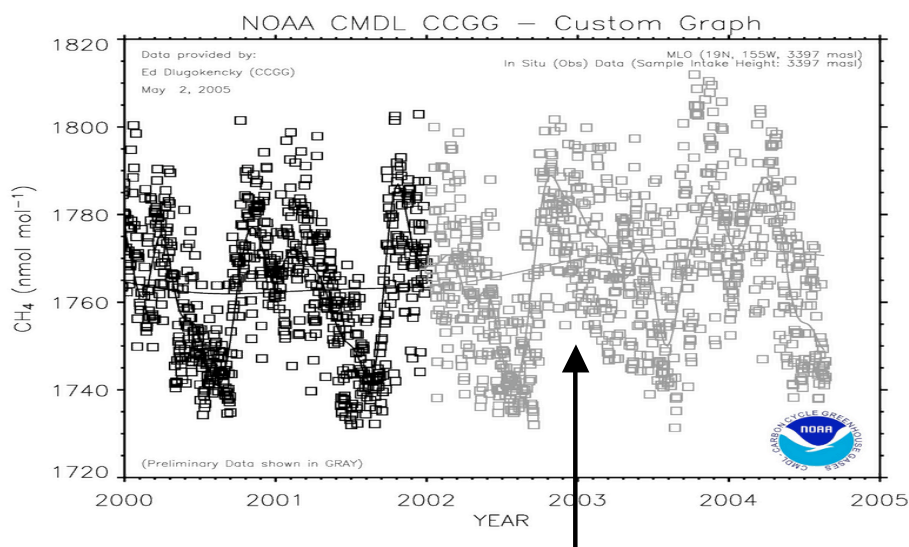


Sept. 2002 to Aug. 2004 CH₄ Movie



CH₄ Validation: CMDL MLO Climatology

Vertical Scales are roughly equivalent. CMDL plot is for MLO @ 20N Lat.



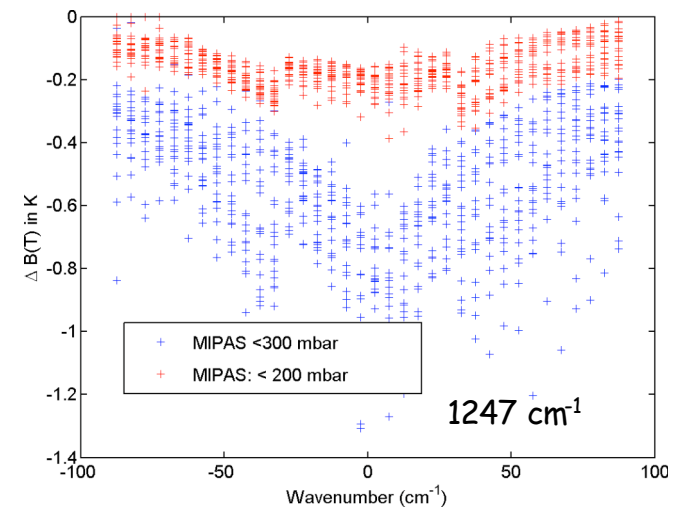
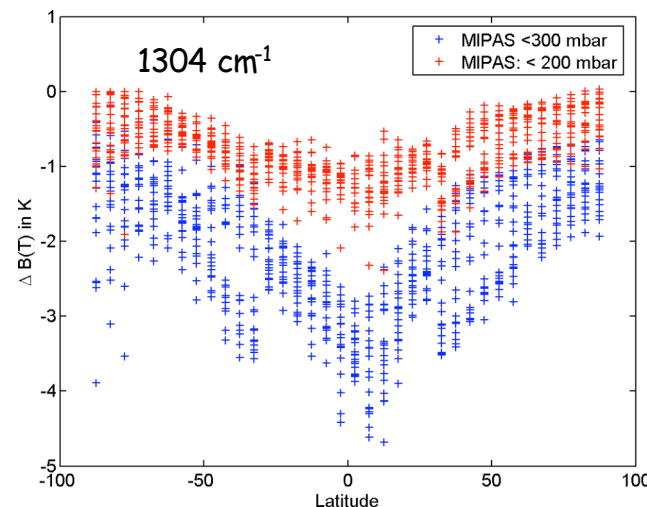
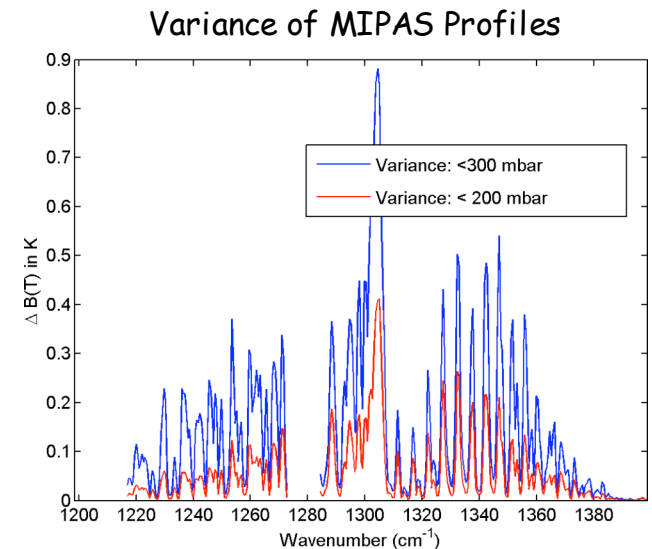
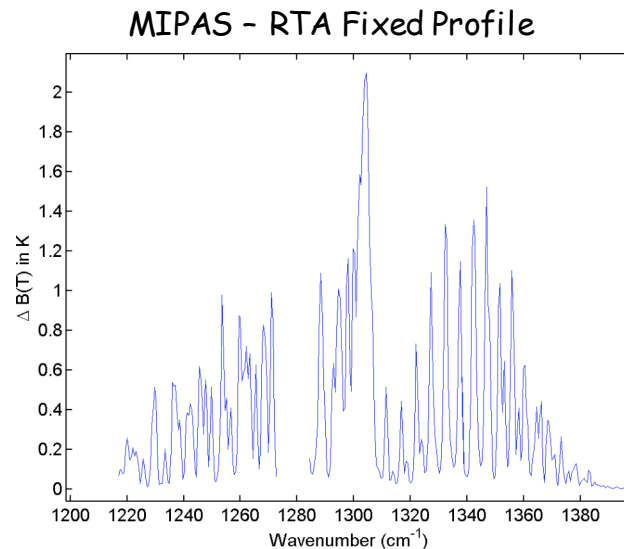
Validation with MIPAS on ENVISAT (AIRS Sees Upper Trop/Strat CH₄)

MIPAS is a limb sounding
IR interferometer on
ENVISAT

They have generated
monthly mean climatologies
for CH₄, from ~300 mbar
to high in the stratosphere.

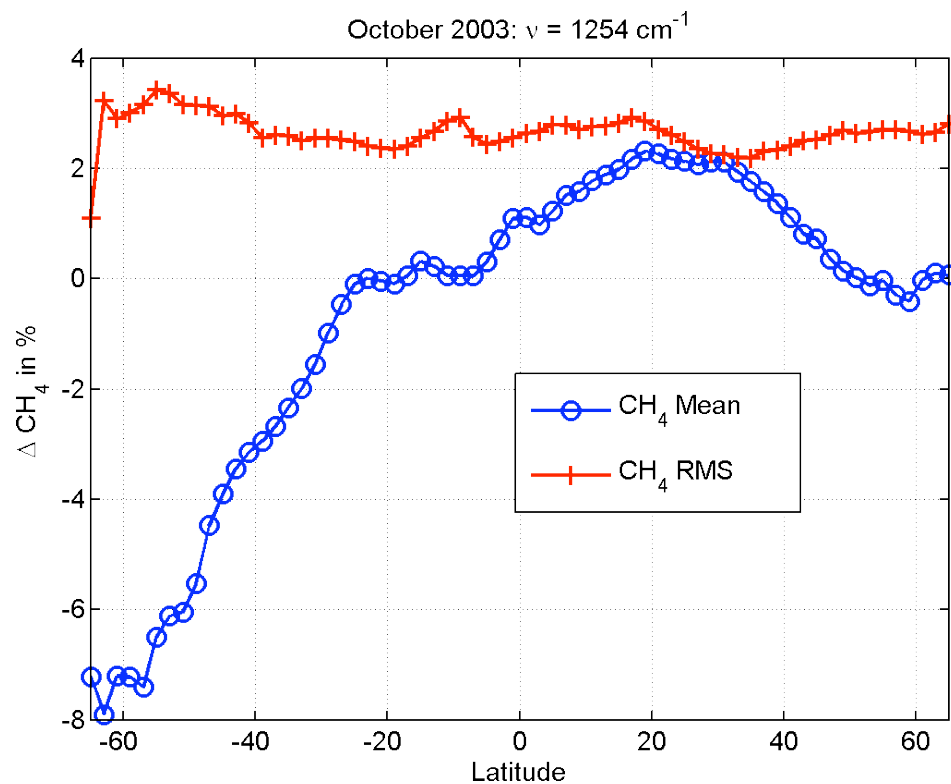
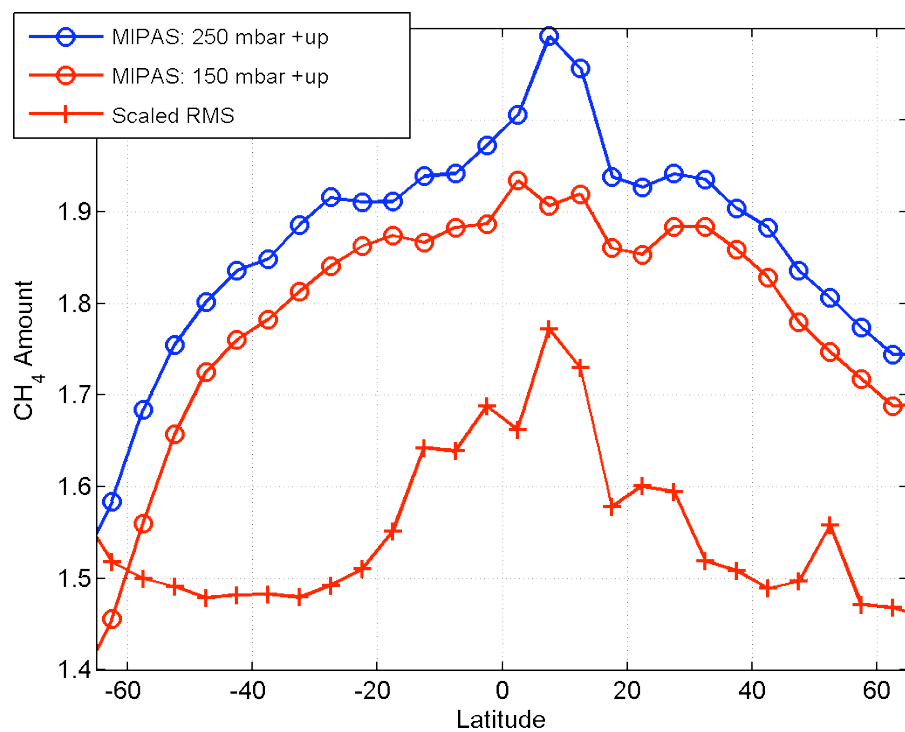
Their 200-300 mbar data
has high variance.

We have imported MIPAS
profiles into SARTA and
"translated" MIPAS CH₄
variability to B(T) units



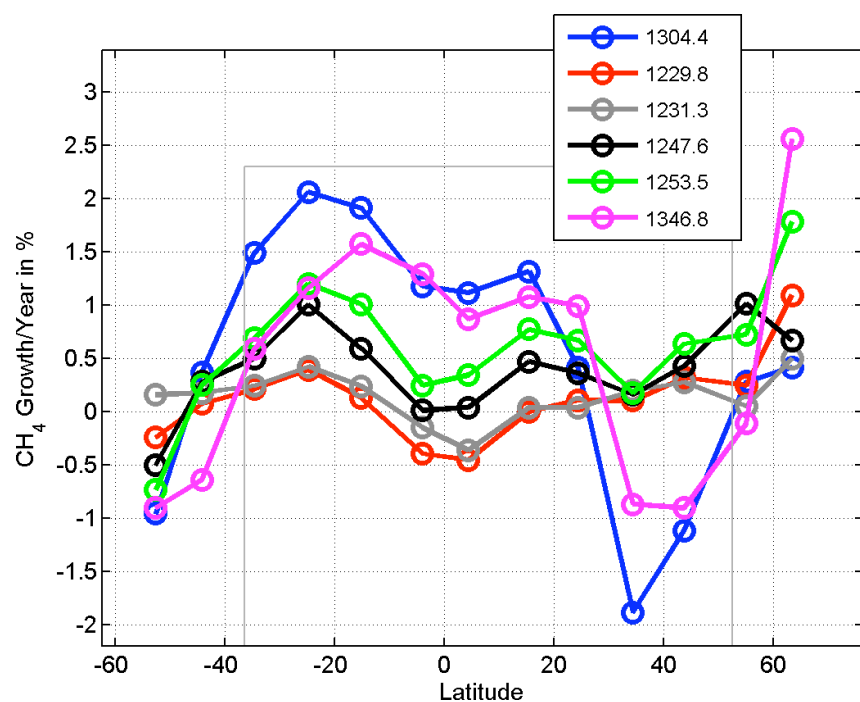
MIPAS vs AIRS for Oct. 2003

(Details of zonal means are similar.)

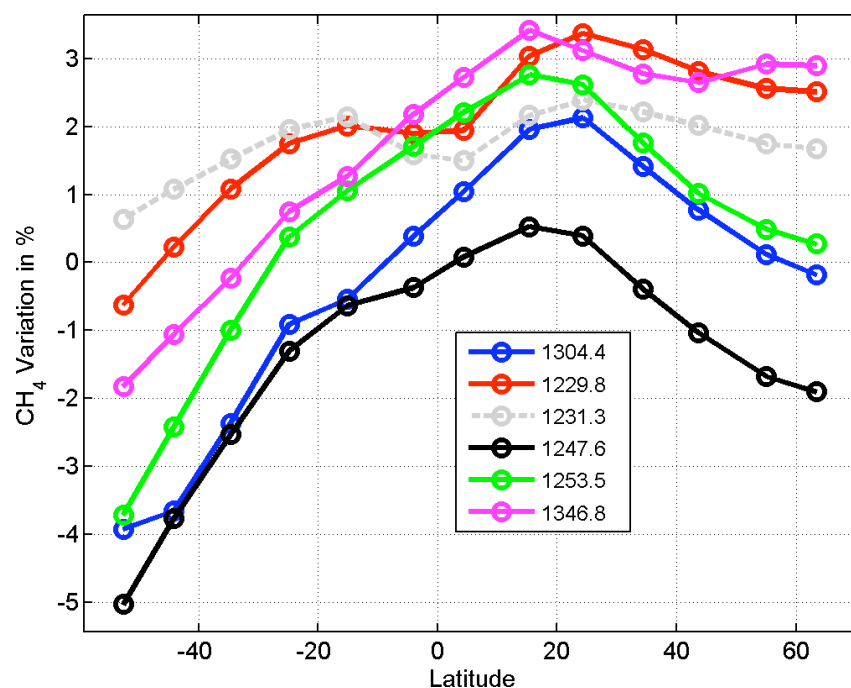


How Repeatable are these Measurements?

CH₄ Growth/Year



Comparisons Among Different CH₄ Channels

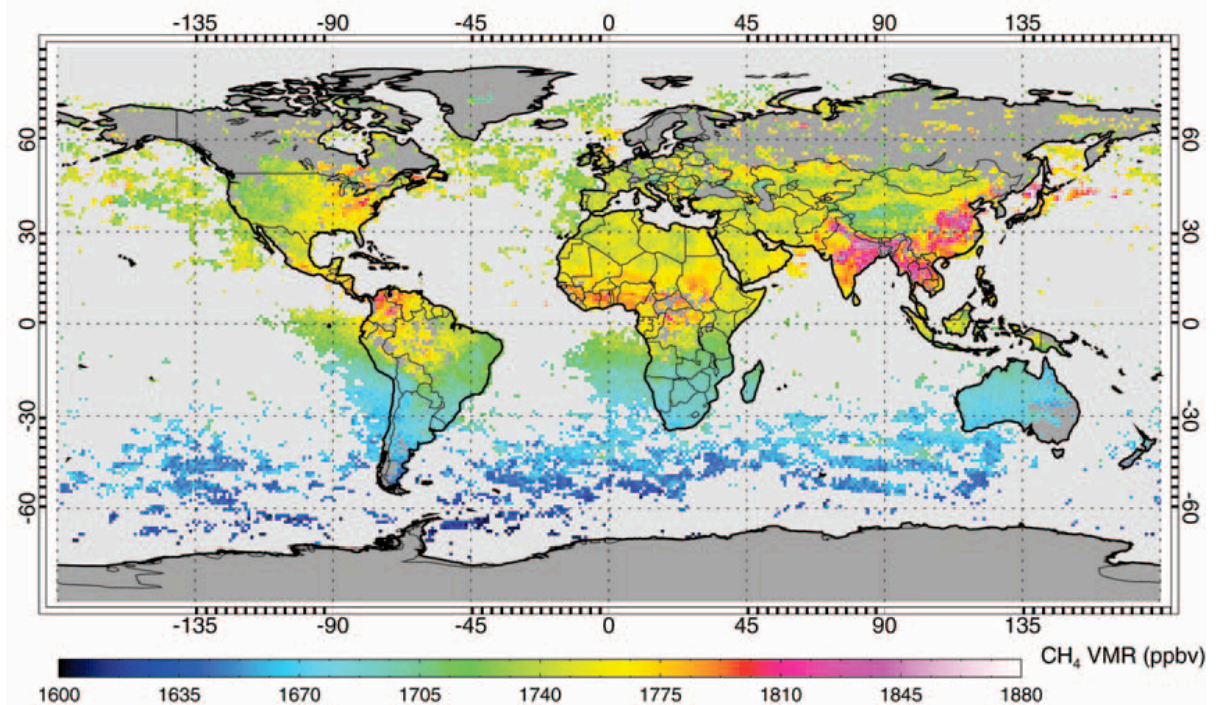


Assessing Methane Emissions from Global Space-Borne Observations

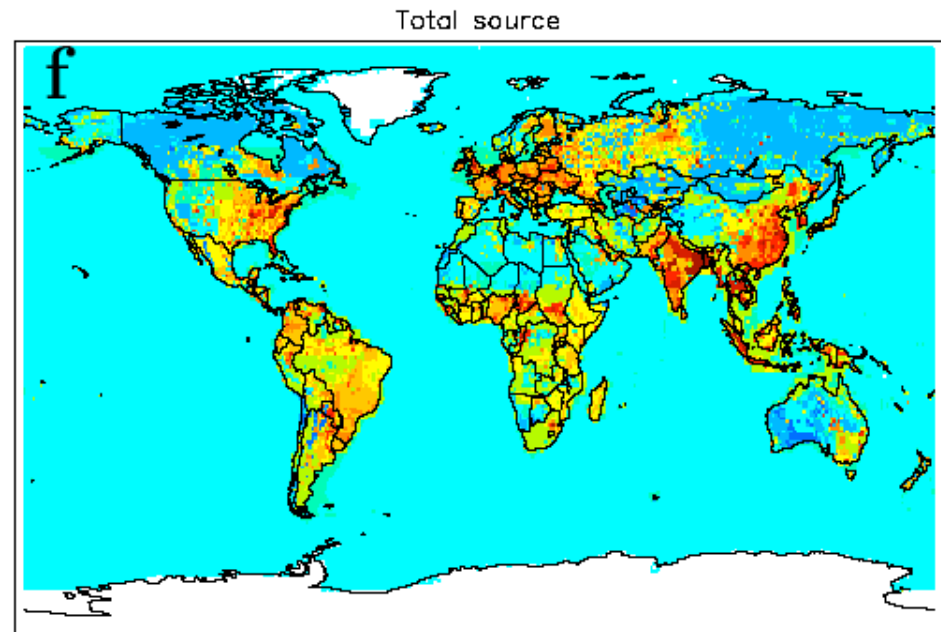
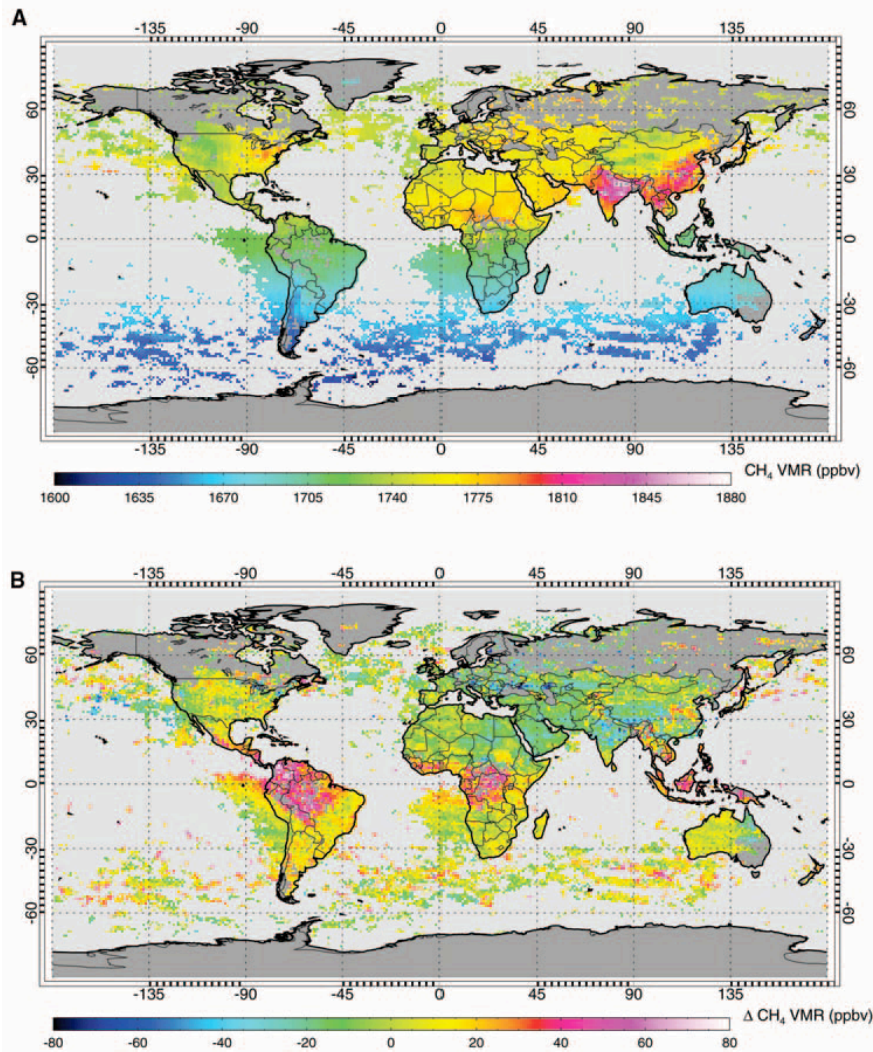
C. Frankenberg¹, J.F. Meirink², M. van Weele², U. Platt¹ & T. Wagner¹

¹Institute of environmental physics, University of Heidelberg, INF 229, 69120 Heidelberg, Germany. ²Royal Netherlands Meteorological Institute, Section of Atmospheric Composition, P.O.Box 201, 3730 AE De Bilt, The Netherlands.

In the past two centuries, atmospheric methane has more than doubled and now constitutes 20% of the anthropogenic climate forcing by greenhouse gases. Yet its sources are not well quantified, introducing uncertainties in its global budget. We retrieved the global methane distribution using space-borne near-infrared absorption spectroscopy. In addition to the expected latitudinal gradient, we detect large-scale patterns of anthropogenic and natural methane emissions. Furthermore, we observe unexpectedly high methane concentrations over tropical rainforests revealing that emission inventories considerably underestimate methane sources in these regions during the time period of investigation (August–November 2003).



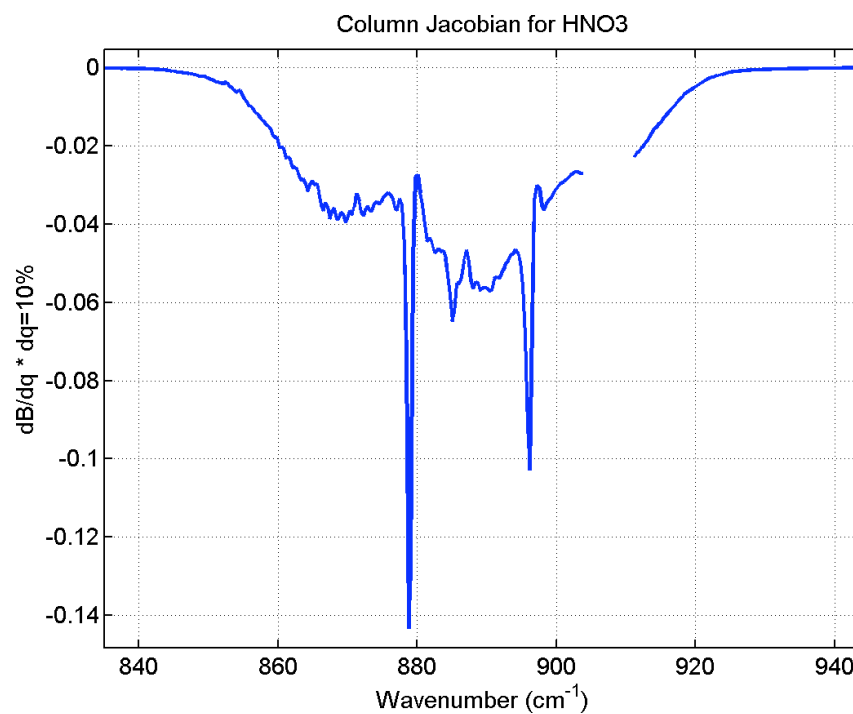
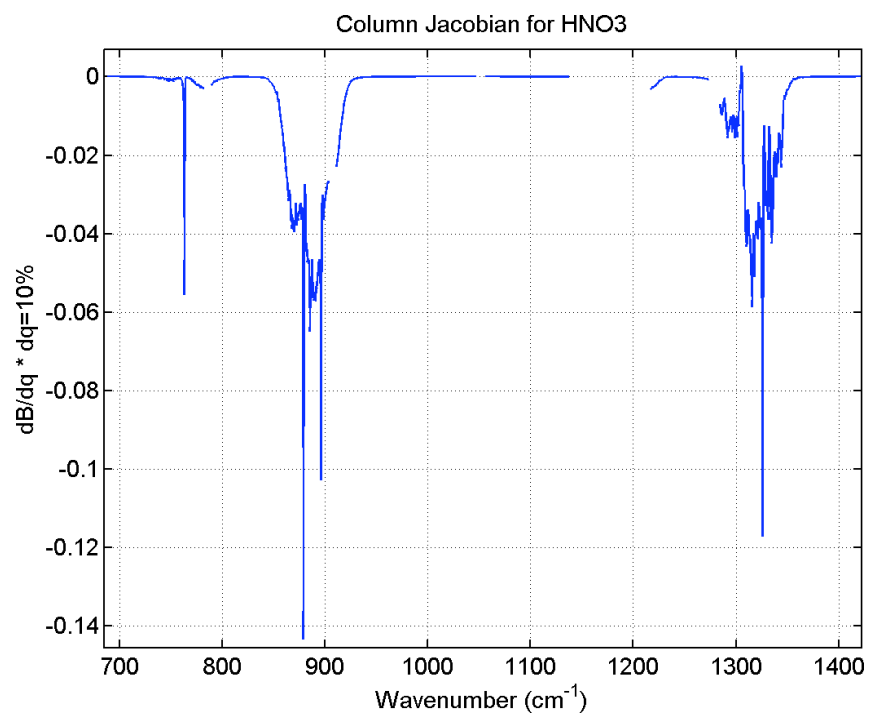
Excess CH_4 Over Tropics Compared to Model



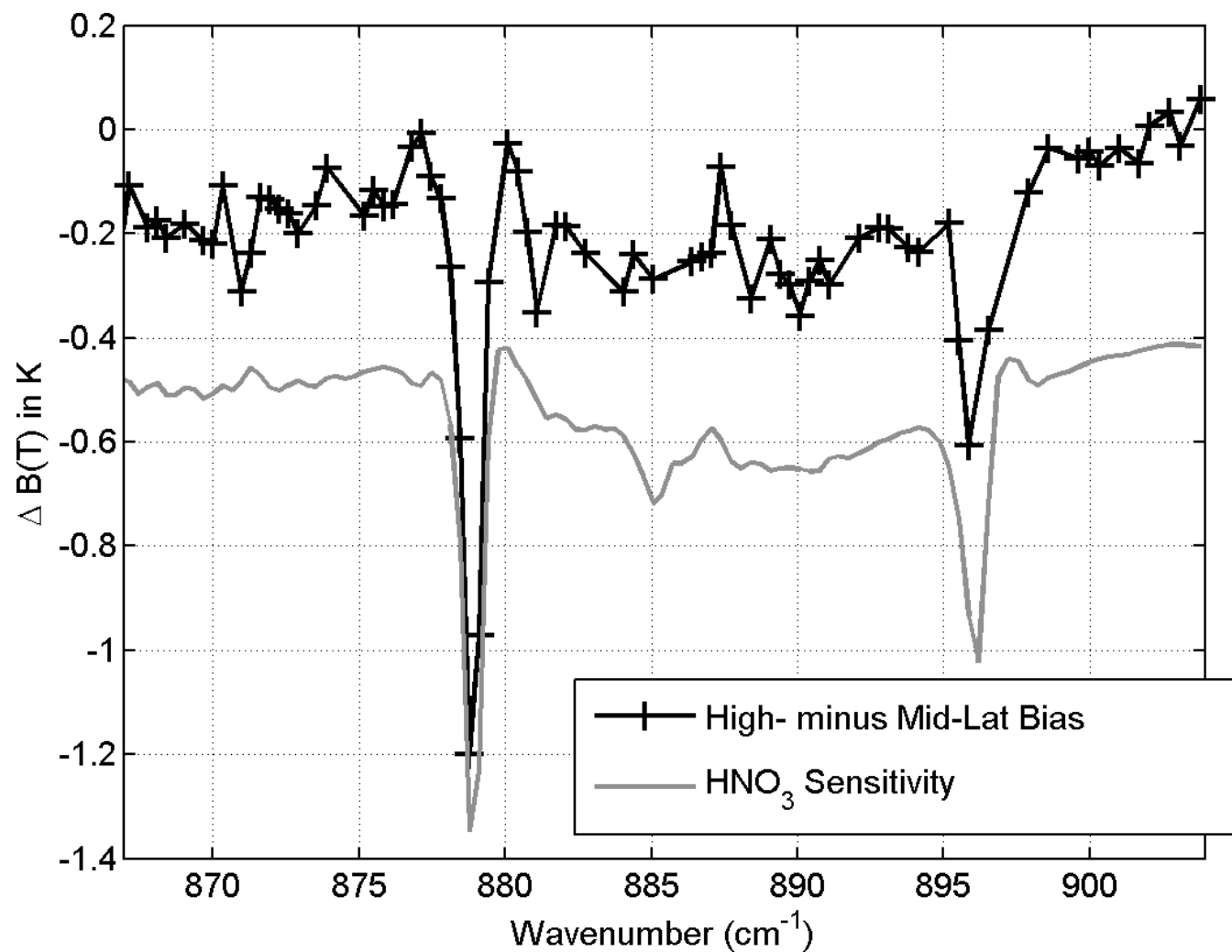
Summary

- AIRS has good CH₄ sensitivity
- But, very wide weighting functions
 - Sensitive to stratosphere
- How interpret results?
- What can AIRS provide compared to other instruments?
- Need other information? MIPAS, SCHIMACHY?
- Retrievals over land should give better validation information, especially with Maddy/Barnet individual retrievals
- Need to work with modelers

HNO₃ Jacobians

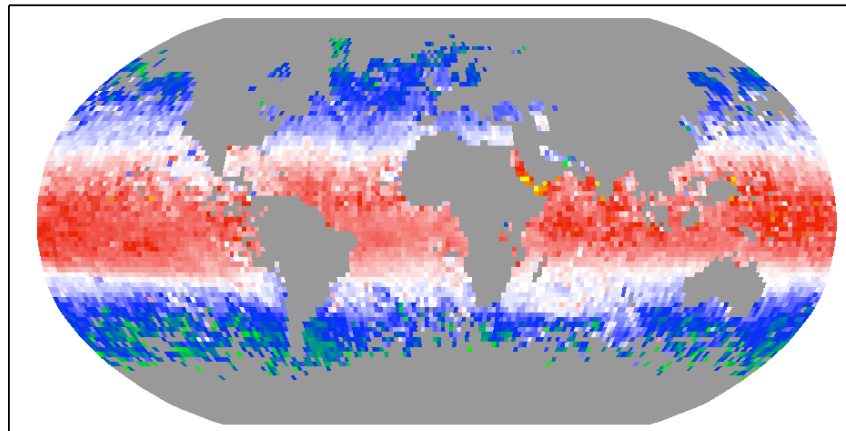


Observed Variation in HNO_3 Bias with Latitude

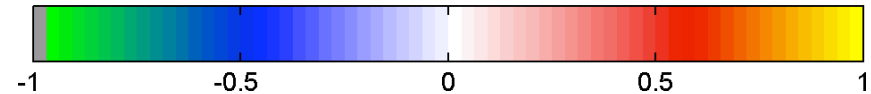
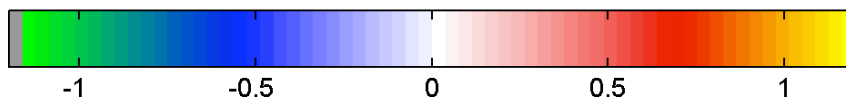
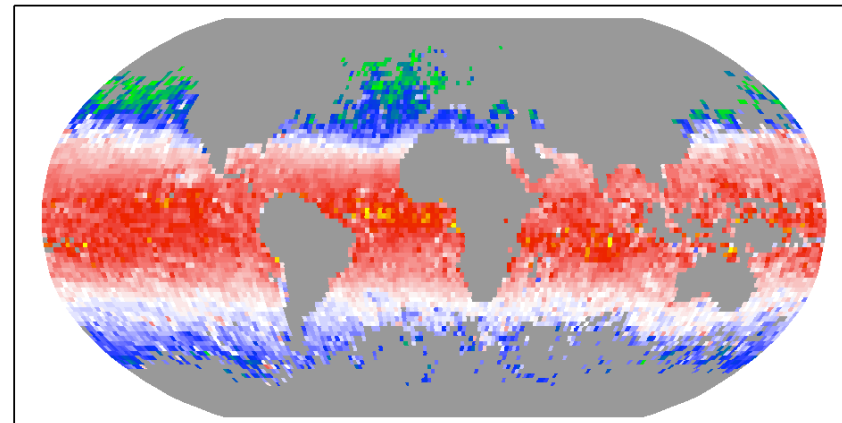


HNO₃ Maps: 6-months apart

HNO₃: Aug. 2003

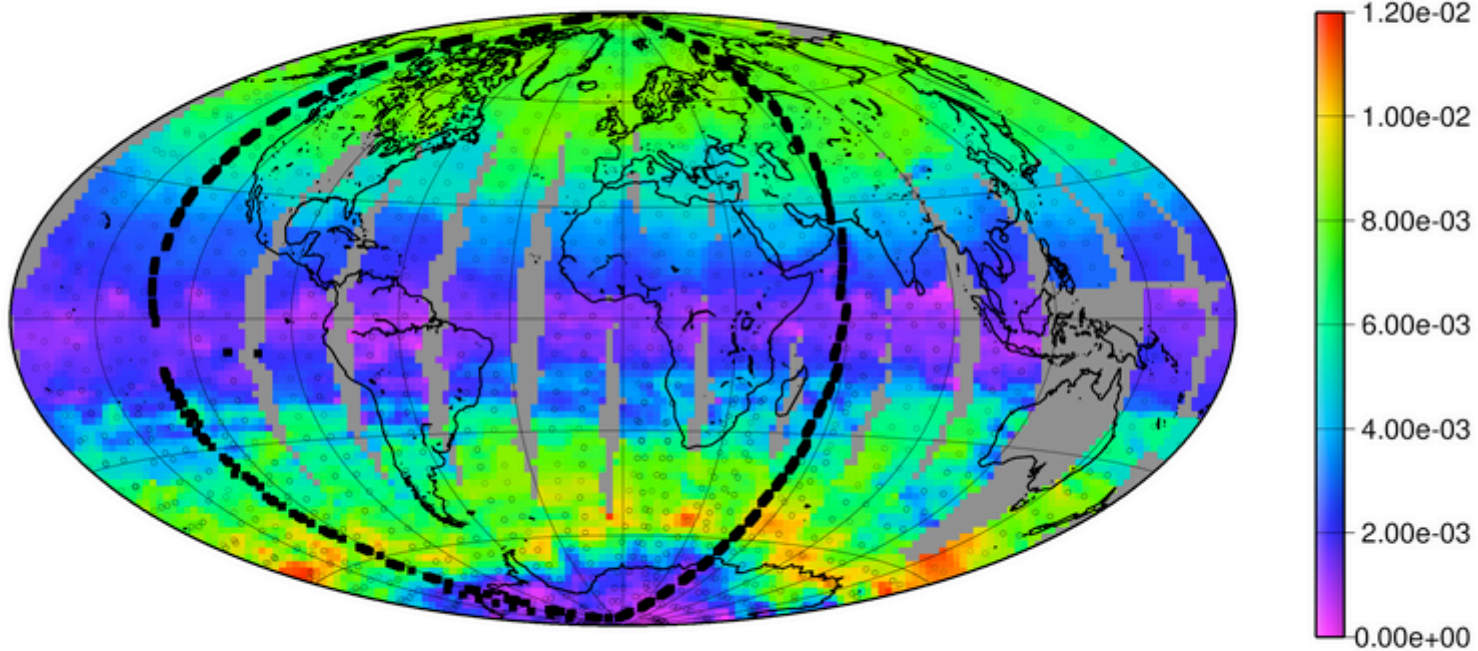


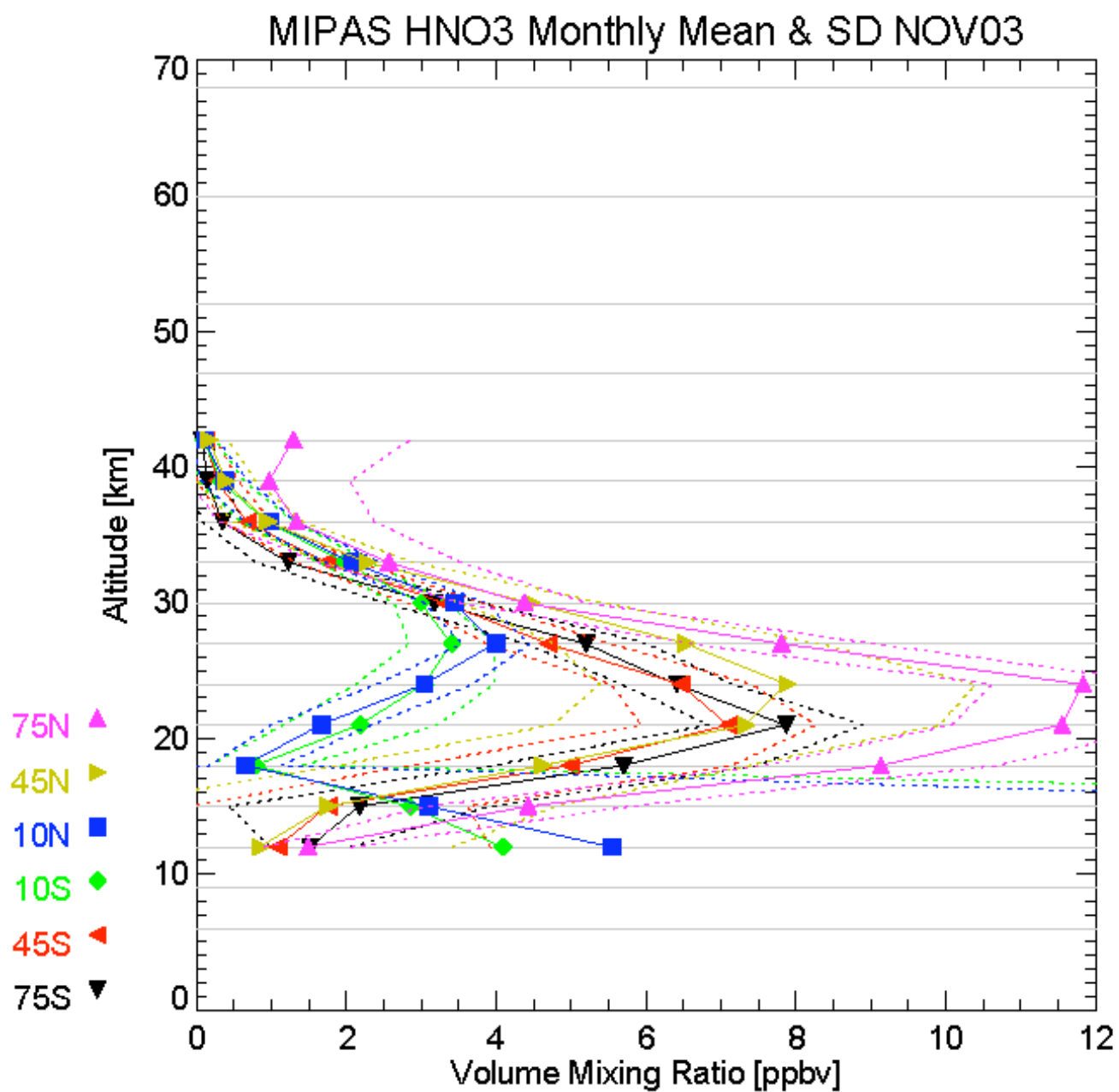
HNO₃: Feb. 2004



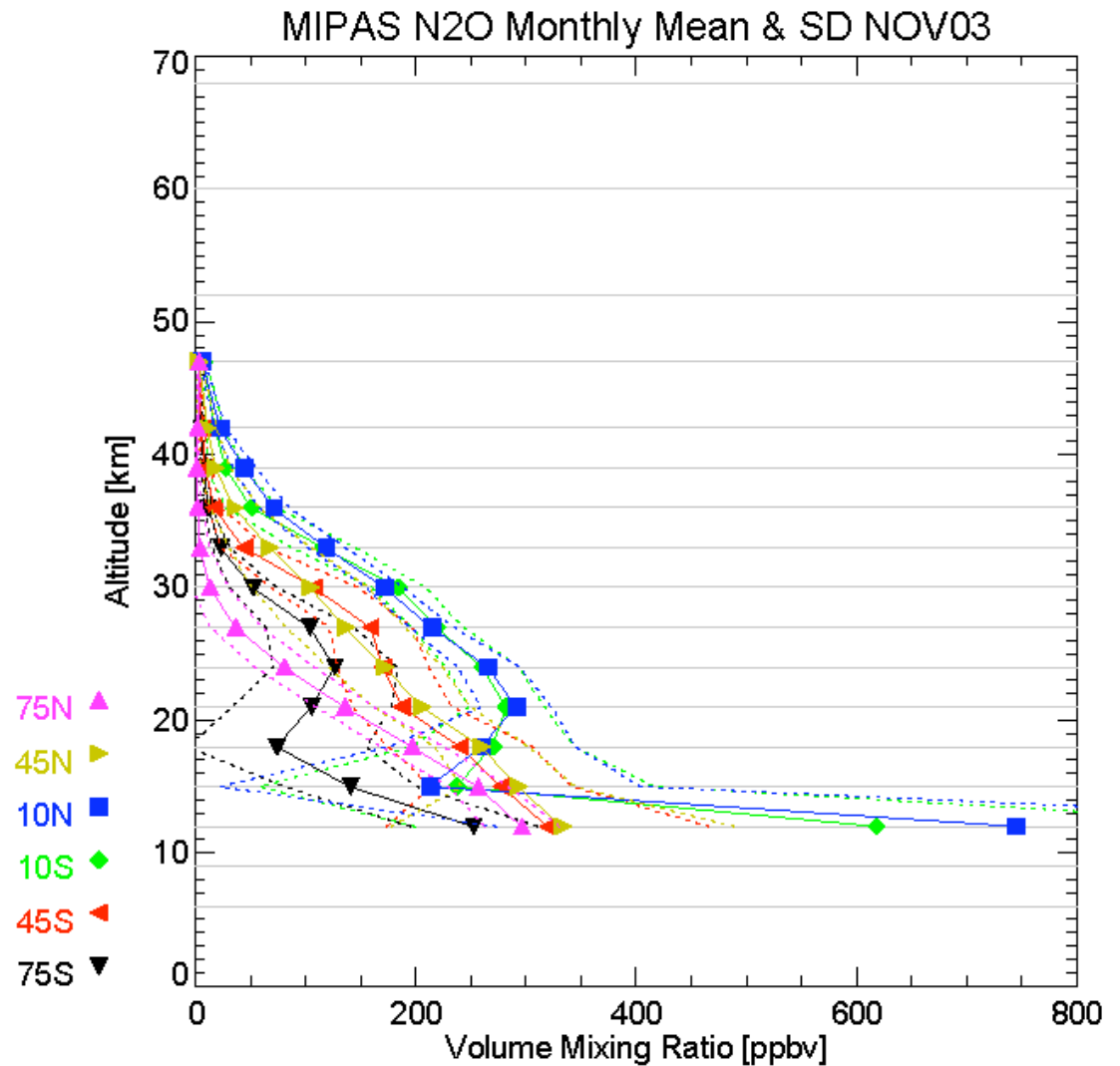
Scale is bias in K, Δ HNO₃ of 10% is
~0.12K in B(T)

Global Result: 100% Variation in our Maps is Reasonable



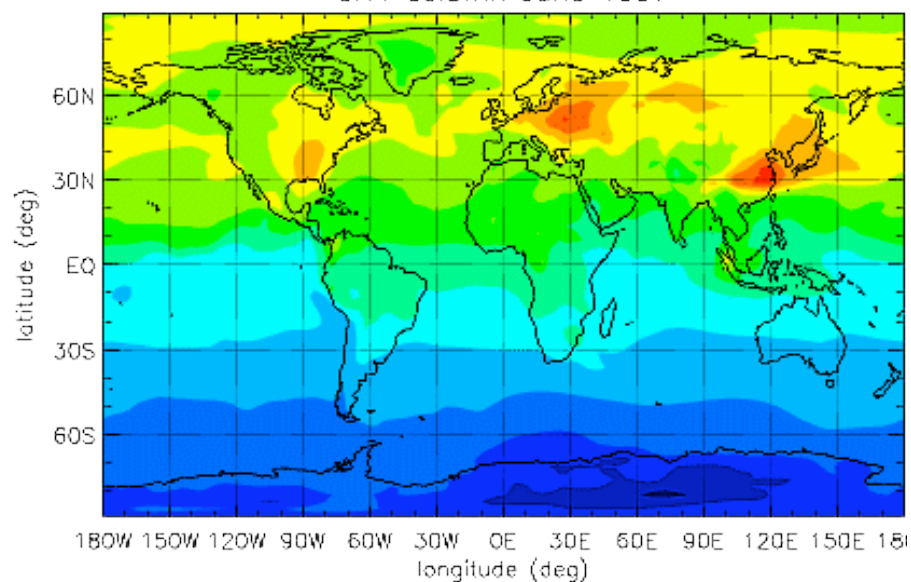


N_2O variability in the stratosphere will probably affect AIRS N_2O channels as well.



CH₄ Model: Need to find one

CH₄ column June 1997



CH₄ October 2003

